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(71) Applicant: **Graham Engineering Corporation**  
**1420 Sixth Avenue P.O. Box 1104**  
**York Pennsylvania 17405(US)**

(72) Inventor: **Oles, Paul M.**  
**4020 Wilshire Drive**  
**York Pennsylvania 17405(US)**  
Inventor: **Shepps, Frederick J.**  
**711 West Philadelphia Street**  
**York Pennsylvania 17404(US)**

(74) Representative: **Gray, Robin Oliver et al**  
**BARON & WARREN 18 South End Kensington**  
**London W8 5BU(GB)**

(54) **Rotary blow molding machine.**

(57) A rotary blow molding machine includes a base (12), a turntable (14) on the base (12) rotatable about a vertical axis and a number of mold units (20) spaced around the turntable (14). Each mold unit (20) includes a pair of mold halves (98) which close on and capture a growing vertical parison (154) at an extrusion station (22) and then fall away from the parison (154) as the parison is severed. The captured parison (154) is blow molded and cooled as the blow unit (158) is rotated around the turntable (14). The finished article, commonly a bottle, is ejected from between the mold halves (98) before the mold halves (98) return to the extrusion station (22).

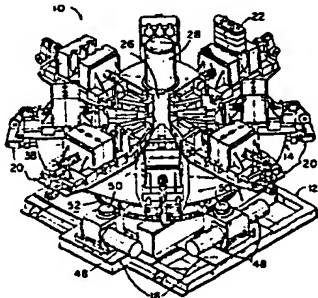


Fig. 1

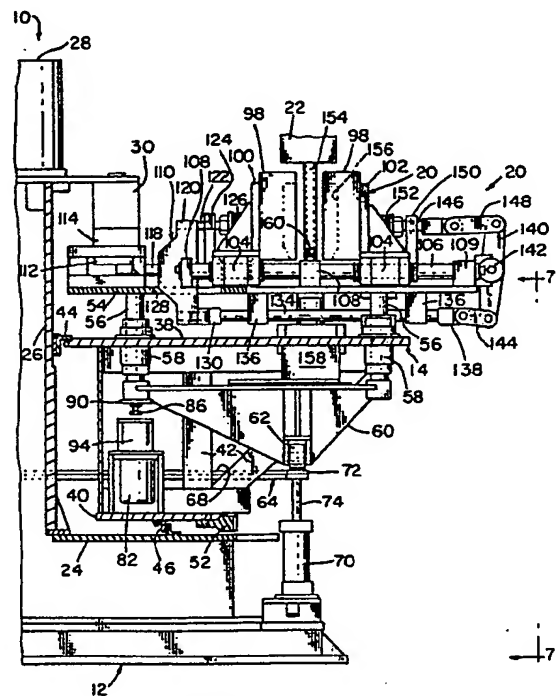


Fig. 3

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### ROTARY BLOW MOLDING MACHINE

The invention relates to horizontal rotary blow molding machines and methods for manufacturing bottles and similar articles from thermoplastic resin parisons.

Horizontal rotary blow molding machines index circumferentially spaced mold halves in steps around a vertical axis. The mold halves each capture a vertical, continuously growing parison at an extrusion station. In one machine the head extruding the parison moves up away from the mold halves after the mold halves close to capture the parison. The parison is severed adjacent the top of the mold halves, the mold halves are moved away from the extrusion station and a top blow pin is moved into the end of the captured parison at the top of the mold halves to seal the mold cavity and blow the parison. Subsequently, the extrusion head and dependent parison are lowered back to the initial position so that the new parison is in position to be captured by the next pair of mold halves. The blown parison cools as the mold halves are rotated around the machine, following which the mold halves open at an ejection station and the finished article, commonly a bottle, is ejected from between the mold halves. The machine includes an in-mold labeling station between the ejection station and the extrusion station for applying labels to the interior surfaces of the mold cavities.

Blowing of the captured parison is delayed until after the mold is moved away from the extrusion head and the blow pin has been moved into engagement with the top of the held parison. This interval of time increases the cycle time for the machine. A mechanism is required to raise and lower the extrusion head. Moving the extrusion head may move the growing parison with the ever-present risk that this movement will cause the end of the long, growing parison to shift laterally, thereby increasing the risk that the parison is not properly aligned when captured in the mold cavity.

When blow molding bottles using a blow pin entering the cavity at the top of the mold, there is a risk that the molten parison resin will gravity-flow down from the top of the cavity before the pin is extended into the cavity and confines the top of the parison against and the cavity mouth. This risk is increased in a machine where the captured parison must be moved a distance away from the extrusion head before the blow pin is inserted down into the mouth at the top of the mold.

In another horizontal rotary blow molding machine the parison grows down over a blow pin at the bottom of the mold halves prior to closing of the mold halves. The extrusion head is moved up above the closed mold prior to severing of the new

parison from the captured parison. The mold is then indexed laterally to the next station without dropping and the captured parison is blown within the cavity. In a further horizontal rotary blow molding machine, the whole turntable supporting all of the mold halves is raised and lowered during rotation as each mold captures a parison at the extrusion station.

According to the invention a blow molding machine comprises a mold unit including a pair of mold halves defining a mold cavity when closed, a drive for indexing the mold unit horizontally to a number of stations including an extrusion station and an ejection station, a fixed extrusion die head located above the extrusion station and operable to extrude a continuously growing resin parison vertically down into the extrusion station, mold clamp means for opening the closed mold halves to permit removal of a blown article at the ejection station and for closing the open mold halves at the extrusion station to capture a parison within the mold cavity, vertical position means for both holding the mold unit in an elevated position when moved to the extrusion station so that the open mold halves move to either side of the parison growing down from the extrusion die head prior to closing of the mold halves and capture of the parison and releasing the mold unit so that its gravity falls vertically down from the elevated position faster than the rate of parison growth, parison separation means operable so that the captured parison is separated from the new parison growing from the extrusion head above the mold halves, blow means for expanding the captured parison against the mold cavity, and mold unit rise means located away from the extrusion station for raising the mold unit to the elevated position prior to return of the mold unit to the extrusion station, whereby the parison is captured between the closed mold halves, separated from the new parison and then blow molded against the cavity as the mold unit is moved between the stations.

The present horizontal rotary blow molding machine indexes a number of mold halves around the circumference of a turntable past a plurality of stations. Elevated blow molds are indexed to an extrusion station to either side of a vertically growing parison extending down from a fixed extrusion head. The mold halves close to capture the parison and are then immediately dropped vertically below the extrusion head at a rate faster than the rate of parison growth. As the closed mold drops the parison is severed, either by tensile-breaking a weakened portion of the parison above the mold halves or by a cutting knife. When captured, the lower end

of the parison extends over a blow pin located below the mold. Following closing of the mold halves on the parison blow air is flowed through the blow pin into the interior of the parison to expand the parison against the mold cavity. The lower end of the parison captured between the blow pin and the mouth of the cavity is confined and cannot flow away from the pin. The mold may be indexed away from the extrusion station immediately after severing of the captured parison.

The mold halves close on the parison and quickly move down from the stationary extrusion head and forming new parison without laterally disturbing the new parison. Blow molding commences immediately upon closing of the mold halves. These steps permit the machine to rapidly blow mold the parison, thereby decreasing the amount of time required to cycle the individual mold halves around the machine and make the blow molded articles, commonly bottles. The new parison grows straight down in position to extend over the blow pin of the next elevated mold moved to the extrusion station.

Each pair of mold halves is mounted on a movable mold unit for vertical movement relative to the extrusion head. A cam raises the mold unit to the elevated position from which the mold unit is indexed to the extrusion station and supported on a movable pad. After closing of the mold halves to capture the parison the pad is rapidly withdrawn, allowing the mold unit to gravity-fall away from the new growing parison. The falling mold unit engages a pair of shock absorbers which slow the unit before engaging a pair of supports. The mold unit may be indexed away from the extrusion station after severing of the parison and before the unit has fallen all the way down to the supports.

The machine also includes an improved mold clamp drive for moving both mold halves toward each other to capture the parison between the mold halves. The drive is actuated by a driver located radially inwardly of the mold halves. The drive forces the inner mold half radially outwardly along a pair of slide bars. The inner mold half is pushed by a clamp rod located a distance above the slide bars. The motion of the clamp drive is transmitted under the mold halves by actuating rods to a pivot bar located radially outwardly of the mold halves and then back to the mold halves, reversed in direction, by a second clamp rod. The clamp rods and actuating rods are located equal distances above and below the slide bars so that the mold halves are closed without subjecting the slide bars to high torsional forces. These forces could bend the slide bars and could prevent proper closing of the mold cavity.

The invention will now be described, by way of example, with reference to the accompanying part-

ly diagrammatic drawings, in which:-

Figure 1 is a perspective view of a rotary blow molding machine according to the invention;

Figure 2 is a top view of the machine of Figure 1, partially broken away;

Figure 3 is a sectional view taken generally along line 3--3 of Figure 2 and with mold halves open;

Figure 4 is a view similar to Figure 3 but showing the mold halves closed;

Figure 5 is a top view, partially broken away, of the mold unit of Figure 3;

Figure 6 is a partial bottom view of the mold unit of Figure 5;

Figure 7 is a partially broken away view taken along line 7--7 of Figure 3;

Figure 8 is a diagrammatic view showing the lift cam, the vertical position of the mold assemblies at each station around the machine and the drop cylinder; and

Figure 9 is an enlarged sectional view taken generally along line 9--9 of Figure 7.

Rotary blow molding machine 10 includes base 12, a turntable 14 mounted on the base for rotation around a vertical axis in the direction of arrow 16 and a turntable drive 18 on the base engagable with the turntable for indexing the turntable around the axis in steps. The turntable dwells for a period at each station 1 through 8.

The turntable carries eight circumferentially spaced mold units 20. During a cycle of operation drive 18 indexes each unit 360 degrees around the machine from extrusion station 1, through molding and cooling stations 2-6, ejection station 7 and in-mold labeling station 8 and then back to the extrusion station 1. A fixed extrusion die head 22 shown in Figures 3 and 4 is located above station 1 and extrudes a parison for each mold cavity. The parisons extruded by the head are captured in a mold halves carried by the mold units, blown and cooled as the mold units are indexed through stations 2 through 6. The resultant articles, commonly bottles, are ejected at station 7. An in-mold labeling device (not illustrated) may supply labels to the open empty mold cavities at station 8 prior to indexing of the mold unit back to station 1.

Base 12 includes a support plate 24 and a central control tower 26 extending upwardly from the plate and aligned with the rotational axis of the machine. A rotary union 28 is mounted on the top of the tower. The union connects each mold unit to suitable cooling water and pressure fluid lines. Driver 30 is mounted on the tower above the inner portion of station 1. Driver 32 is mounted on the tower above the inner portion of station 7. Each driver includes a drive head 34.

The turntable 14 includes upper and lower annular support plates 38 and 40 and suitable framing

42 joining the plates. The turntable is rotatably mounted on the base by bearings 44 and 46 respectively joining plate 38 to tower 26 and plate 40 to plate 24 for rotation of the turntable about the machine axis. Turntable drive 18 includes one or more electric motors 48 driving pinion gears 50 engagable with circumferential bull gear 52 mounted on plate 40.

Each mold unit 20 includes a mounting plate 54 located above support plate 38 and secured to the support plate by three vertical slide rods 56 secured to the bottom of the mounting plate and extending downwardly through sleeve bearings 58 on plate 38. The lower ends of rods 56 extend below plate 38 and are joined to support frame 60. Lift roller 62 is rotatably mounted on frame 60 at a location beneath the center of gravity of the mold unit. As shown in Figures 3 and 7, the roller 62 rotates about a radial axis relative to the machine axis.

Lift cam 64 on base 12 extends around the circumference of the machine from shortly after station 6 to station 1. See Figures 3 and 8. The cam includes a rise surface 66 located between stations 6 and 7 and an elevated dwell surface 68 extending around the machine between stations 7 and 1. Hydraulic drop cylinder 70 is mounted on frame 12 at a position beneath roller 62 when a mold unit is in station 1. A support pad 72 is mounted on the end of cylinder rod 74. When the cylinder is extended the pad forms a continuation of dwell surface 68 to support the mold unit 20 at station 1 in an elevated position. Pad 72 also carries four alignment shafts 76 (only one of which is illustrated) which extend into bores in cylinder support 78 to prevent twisting and deflection of the pad as the mold unit is moved from the cam to the pad.

As mold units 20 are rotated between stations 6 and 7 rollers 62 engage the rise surface 66 and lift the mold units 20 to the position shown in Figure 3. Following closing of the mold halves the cylinder 70 is rapidly retracted thereby permitting the mold units to fall from the position of Figure 3 to the position of Figure 4. A pair of shock absorbers 80 and 82 are mounted respectively on upper support plate 38 and lower support plate 40 as shown in Figures 3 and 7. Adjustable stops 84 and 86 are mounted respectively on plate 54 and the lower end of the inner slide rod 56 above shock absorbers 80 and 82. The stops extend through strike plates 88 and 90.

Each shock absorber includes a plunger 92 projecting toward the adjacent stop and into a support collar 94 having a resilient pad 96 on the upper end facing the adjacent strike plate. The plunger is connected to a dash pot located in the body of the absorber. Retraction of cylinder 70

permits the mold unit to fall until stops 84 and 86 engage the shock absorber plungers 92 to cushion the fall. Pads 96 also cushion the mold unit fall as the mold unit contact the supports 94.

Mold units 20 each carry a pair of complementary mold halves 98 mounted in inner and outer platens 100 and 102. Each platen carries a pair of sleeve bushings 104 fitted on spaced parallel slide bars 106. The bars are mounted above plate 54 in support blocks 108 and an end block 108 which extends between the outer ends of the slide bars. The mold units each also include a mold clamp drive 110 for moving the platens and mold halves between open and closed positions. Drive 110 includes an actuator 112 mounted on the radial inner end of plate 54 and connected to a driven head 114 located beneath drive head 34 when the mold unit is at station 1. The actuator is located at the same level as the slide bars 106. The driven head 114 is engagable with drive head 34 to form a disengagable connection between driver 30 and the mold clamp drive. Connecting rod 118 joins actuator 112 to vertical yoke 120. The upper end of the yoke is connected to a clamp rod 122 which extends freely through platen support post 124 and engages the outer surface of platen 100 through a stiff spring 126, conventionally a stacked series of dished spring washers.

The lower end of yoke 120 extends through cut-out opening 128 in plate 54 and is connected to first horizontal yoke 130 having ends located outwardly of the sides of central cut-out opening 132 also formed in plate 54. A pair of parallel actuating rods 134 are mounted on the lower surface of plate 54 in blocks 136. The inner ends of rods 134 are secured to the outer ends of horizontal yoke 130 to one side of opening 132. The outer ends of the rods are connected to a second horizontal yoke 138 located outwardly of the opening 132.

A double ended pivot bar 140 is rotatably mounted on a projection 142 extending outward from the center of end block 109. The lower end of bar 140 is connected to a link 144 pivotally connected to the center of second horizontal yoke 138. The upper end of bar 140 is connected to the clamp rod 146 for outer platen 102 through link 148. The clamp rod 146 extends through a platen support post 150 like post 124 and is connected to the outer surface of platen 102 through stiff spring 152 like spring 126.

Mold units 20 are moved to station 1 with the mold halves open. When at station 1 roller 62 is supported on raised pad 72 so that the unit is in the upper position and a drive connection is formed between heads 34 and 114. The mold halves 98 are moved around the growing resin parisons 154 extending down from the head die 22. Head 22 extrudes one parison for each mold cavity in the

mold. Mold halves 98 define three mold cavities 156 for simultaneous blow molding of three bottles.

The mold halves are closed by actuating driver 30 to shift actuator 112 thereby moving the vertical yoke 120 radially outwardly. Outward movement of the upper end of the yoke moves platen 100 and the inner mold half 98 toward the parisons. Outward movement of the lower end of yoke 120 moves actuating rods 134 outwardly to rotate the lower end of pivot bar 140 outwardly so that upper end of the bar is rotated inwardly a corresponding distance and platen 102 and the outer mold half 98 are moved inwardly toward the parisons. Final closing of the mold halves compresses springs 126 and 152 to control the forces biasing the mold halves against each other.

During closing of the mold halves the driver 30 moves the actuator 112 a slight distance past the fully extended position and against a stop. When in this position springs 126 and 152 hold the mold halves together and the actuator against the stop to prevent opening of the mold halves.

Considerable force is required to hold the mold halves 98 together during blow molding. The force required to close the outer mold half 98 is transmitted from vertical yoke 120 underneath the slide bars 106 and plate 54 and then is transmitted back above the bars and plate to clamp rod 146 by the pivot bar 140. The pivot bar rotates about a pivot axis located at the same vertical level as the slide bars 106. The clamp rods 122 and 146 are located the same distance above the slide bars as the actuating rods 134 are located below the slide bars. This arrangement assures that the slide bars 106 and the plate 54 on which they are mounted are not subjected to high torsional forces when the required high closing forces are applied. These forces are sufficient to bend the slide bars and plate and prevent proper closing of the mold halves.

A blow pin unit 158 is mounted on support frame 60 beneath opening 132 and extends up toward mounting plate 54 through an opening in the support plate 38 (not illustrated). The unit includes a vertically extending blow pin 160 for each mold cavity 156. As shown in Figures 3 and 4, unit 158 extends upwardly through the opening so that the blow pins are located adjacent the mouth portions of the inverted blow cavities.

A microprocessor control unit (not illustrated) operates rotary blow molding machine 10 and the extruder or extruders supplying molten resin to extrusion die head 22. The turntable drive indexes the turntable in the direction of arrow 16 45 degrees at a time so that each mold unit 20 is moved in a clockwise direction from a former station to the adjacent clockwise station. Following indexing the drive is deactivated for a dwell period prior to the

next indexing step.

The operation of machine 12 is described by following a single mold unit completely around the machine from station 1 through stations 2 through 8 and back to station 1.

When indexed from station 8 to station 1 the mold halves 98 are fully open. The mold halves are rotated to station 1 to either side of the growing parisons 154 extending vertically below the extrusion die head 22. With the turntable drive deactivated and the mold unit dwelling at station 1 the lower ends of the parisons grow down over the upper ends of the blow pins 160. The cylinder 70 is extended so that support pad 72 forms a continuation of the end of lift cam dwell surface 68. See Figures 3 and 7. Roller 62 rests on raised pad 72 to hold the mold unit in the elevated position of Figure 3 with driven head 114 adjacent and engaged with drive head 34. As soon as the lead ends of the parisons have grown down over the blow pin, driver 30 is actuated to shift the actuator 112 radially outwardly to close the mold halves 98 and capture each parison in a mold cavity.

The extrusion die head 22 is programmable to vary the thickness of the parisons depending upon the blow ratio. The programmer automatically thins the wall sections of the parisons as the mold halves close to provide thin, weak parisons immediately above the closed mold halves. On closing of the mold halves cylinder 70 is rapidly retracted and pad 72 is accelerated down away from roller 62. Rapid retraction of the pad allows the mold unit 20 to gravity-fall from the elevated position of Figure 3 to the lower position of Figure 4 where the unit is supported by collars 94. The mold unit free falls until adjustable stops 84 and 86 engage the shock absorber plungers 92 and the shock absorbers slow the descent of the unit until pads 88 and 90 engage resilient pads 96 on the tops of the collars 94. Initial vertical descent of the closed mold halves breaks the thin portion of the parisons to free the captured parisons in the mold halves from the lower end of the newly formed, continuously growing parisons 162. The mold halves fall down faster than the parisons grow. Breakaway of the captured parisons occurs as the mold falls straight down without lateral shifting of the newly forming parisons. Shifting could prevent the growing new parisons from surrounding the blow pins 160 of the next mold unit.

After breakaway of the captured parisons, the controller actuates the drive 18 to rotate the turntable 14 through 45 degrees and index the mold unit from position 1 to position 2. Indexing preferably begins before the unit has fallen onto collars 94. At the same time, a new mold unit with open mold halves is indexed from station 8 to station 1. Cylinder 70 is extended to raise pad 72 to the level

of the dwell surface 68 during indexing to support the roller of the mold unit moving to station 1. During indexing, driver 30 is actuated to return drive head 34 to a position for engaging and shifting the actuator of the next mold unit and closing the mold halves of the unit.

Closing of the mold halves captures the lower ends of the parisons between the blow pins and the mouths of the inverted mold cavities. After the mold halves begin to drop pressurized blow air flows through the pins and into the interior of the parisons to blow the parisons against the closed mold halves and form bottles or articles conforming to the shape of the mold cavities.

The mold halves remain closed and the mold unit remains in the lower position supported by collars 94 as the unit is rotated through stations 2, 3, 4, 5 and 6. During this time cooling water flowed through the mold halves cools the expanded parisons to form rigid, cooled bottles or articles. The water flows to and from the mold halves through conduits (not illustrated) joining each mold half to rotary union 28.

During indexing of the turntable to move the mold unit from station 6 to station 7 roller 62 contacts lift cam rise surface 66 and the mold unit is moved up onto dwell surface 68 at station 7. Movement of the mold unit to station 7 moves driven head 114 beneath and into engagement with the drive head 34 of driver 32 shown in Figure 2. During the dwell period when the mold unit is in station 7 driver 32 is actuated to open the mold halves. Ejection tooling (not illustrated) at station 7 removes the formed and cooled bottles from between the opened mold halves. Driver 32 is returned to the start position as the mold unit is indexed to station 8.

Further indexing of the turntable 14 moves the mold unit to station 8. An in-mold labeling device may be provided at this station to apply labels to the interior walls of the mold cavities 156. The labels become an integral part of the blow molded article in a conventional manner. Subsequent indexing of the turntable returns the open mold unit to station 1 to complete the cycle of operation.

The disclosed blow molding machine 10 includes mold units carrying three cavity mold halves so that three bottles are blow molded by each mold during one cycle of operation. The machine may be used to mold greater or fewer bottles or articles as required. Also, the articles may be blown by blow pins as illustrated or by blow needles where desired.

The captured parisons may be severed from the newly forming parisons 162 using conventional cutting tooling, if required. In such case, it is not necessary to thin the walls of the parisons above the closed mold halves.

In the disclosed example the mold units gravity-fall down from the elevated position. Alternatively, the units may be lowered by a fast acting mechanical or hydraulic drive.

Machine 10 as described blow molds articles in each mold unit. Alternatively, it is possible to run the machine 10 so that articles are blow molded by alternate mold units only with the remaining four unused units left open. In this case drive 18 may index the turntable 90 degrees at a time.

Machine 10 may be set up with four 90 degrees spaced mold units each carrying molds for making one type of bottle or article and the other 90 degrees space mold units carrying molds for making another type of bottle or article. The machine may be run using either set of molds by indexing the turntable 90 degrees between dwells and leaving the other unused molds open. This flexibility is particularly useful when bottles or articles are made in short production runs or when the production facility includes only a single blow molding machine. If desired, the machine may be run using both sets of the molds to make different types of articles or bottles during a single production run.

## Claims

1. A blow molding machine (10) comprising:
  - a. a mold unit (20) including a pair of mold halves (98) defining a mold cavity when closed,
  - b. a drive (28) for indexing the mold unit (20) horizontally to a number of stations (1-8) including an extrusion station (1) and an ejection station (7),
  - c. a fixed extrusion die head (22) located above the extrusion station (1) and operable to extrude a continuously growing resin parison (154) vertically down into the extrusion station (1),
  - d. mold clamp means (110) for opening the closed mold halves (98) to permit removal of a blown article at the ejection station (7) and for closing the open mold halves (98) at the extrusion station (1) to capture a parison (154) within the mold cavity (156),
  - e. vertical positioning means (64, 70) for both 1) holding the mold unit (20) in an elevated position when moved to the extrusion station (1) so that the open mold halves (98) move to either side of the parison growing down from the extrusion die head (22) prior to closing of the mold halves (98) and capture of the parison (154) and 2) releasing the mold unit (20) so that its gravity falls vertically down from the elevated position faster than the rate of parison growth,



f. parison separation means (70) operable so that the captured parison (154) is separated from the new parison growing from the extrusion head (22) above the mold halves,

g. blow means (158) for expanding the captured parison (153) against the mold cavity (156), and

h. mold unit rise means (66) located away from the extrusion station (1) for raising the mold unit (20) to the elevated position prior to return of the mold unit (20) to the extrusion station (1), whereby the parison (154) is captured between the closed mold halves (98), separated from the new parison and then blow molded against the cavity (156) as the mold unit (20) is moved between the stations.

2. A blow molding machine as in claim 1 characterised in that parison separation means comprises means for reducing the wall thickness of the parison (154) above the closed mold halves (98) whereby movement of the mold halves (98) down from the elevated position breaks the parison (154) at the reduced thickness wall.

3. A blow molding machine as in claim 1 characterised in that said parison separation means comprises a knife operable to sever the parison above the closed mold halves (98).

4. A rotary blow machine as in claim 1 characterised in that the mold unit rise means (66) includes a lift cam (64).

5. A blow molding machine as in claim 1 characterised in that said vertical positioning (70) means comprises a support surface (72) engagable with a support member (62) on the mold unit (20) to hold the mold unit (20) in the elevated position during movement to the extrusion station (1), the support member (62) being located under the center of gravity of the mold unit (20); the machine (10) including connection means (56,58) for permitting vertical movement of the mold unit (20); a support (74) at the extrusion station (1) holding the mold unit (20) in the elevated position until the mold halves (98) close on the parison (154) and means (70) for withdrawing the support (74) thereafter to permit the mold unit (20) to gravity-fall away from the extrusion head die (22).

6. A blow molding machine as in claim 1 characterised by a turntable (14) rotatable about a vertical axis, a horizontal support plate (38) on the turntable (14), a plurality of mold units (20) circumferentially spaced around the support plate (38) whereby the drive (28) rotates the turntable (14) to index the mold units (20) successively to the extrusion (1) and ejection (7) stations and a plurality of vertical slide connections (56,58) joining the mold units (20) to the support plate (38).

7. A rotary blow molding machine as in claim 6 characterised in that each mold unit (20) includes a mounting plate (54) and a lift member (72) below the support plate (54); said vertical positioning means (70,64) including a lift cam (64) extending partially around the circumference of the machine beneath the support plate (56), the lift cam (64) including an elevated end (68) at the extrusion station (1) and a rise surface (66) engagable with the lift member (62) remote from extrusion station (1) for lifting the mold unit (20) to the elevated position prior to indexing to the extrusion station (1), a support pad (72) forming an extension of the lift cam (64) at the extrusion station (1) when in an upper position for supporting the mold unit (20) in the elevated position at the extrusion station (1), and support pad drive means (70) for moving the pad (72) from the pad upper position away from the lift member (62) to allow the mold unit (20) to gravity fall vertically down from the elevated position.

8. A rotary blow molding machine as in claim 7 characterised in that the lift cam (64) includes a dwell surface (68) extending from the ejection station (8) to said end of the cam.

9. A rotary blow molding machine as in claim 7 and 8 characterised by shock absorbing means (80,82) on the turntable for slowing the descent of the mold units.

10. A rotary blow molding machine as in claim 7 wherein each mold unit includes a radial slide connection (102,106) securing each mold half to the mounting plate.

11. A rotary blow molding machine as in claim 10 wherein said mold clamp means (110) includes an actuator (114) on the radial inner end of the mounting plate (54), a pivot bar (140) on the radial outer end of the mounting plate (54), the pivot bar (140) having a pivot connection (142) at the level of the radial slide connection (106) and upper and lower ends, a first connection (122) joining the actuator (114) to one mold half (100,98) located a first distance above the slide connection, a second connection (134) joining the actuator (114) to the lower end of the pivot bar (140) located a second distance below the slide connection (106), and a third connection (146,148) joining the upper end of the pivot bar (140) to the other mold half (98,102) located a third distance above the slide connection (106), all of said distances being equal, whereby movement of the actuator (114) closes the mold halves (98) without subjecting the slide (106) connection to substantial torsional loading.

12. A rotary blow molding machine as in claim 11 characterised in that the second connection (134) is located below the mounting plate (54).

13. A rotary blow molding machine as in claim 12 characterised in that the upper and lower ends of the pivot bar (140) are of equal length.

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Neu eingereicht / Newly filed  
Nouvellement déposé

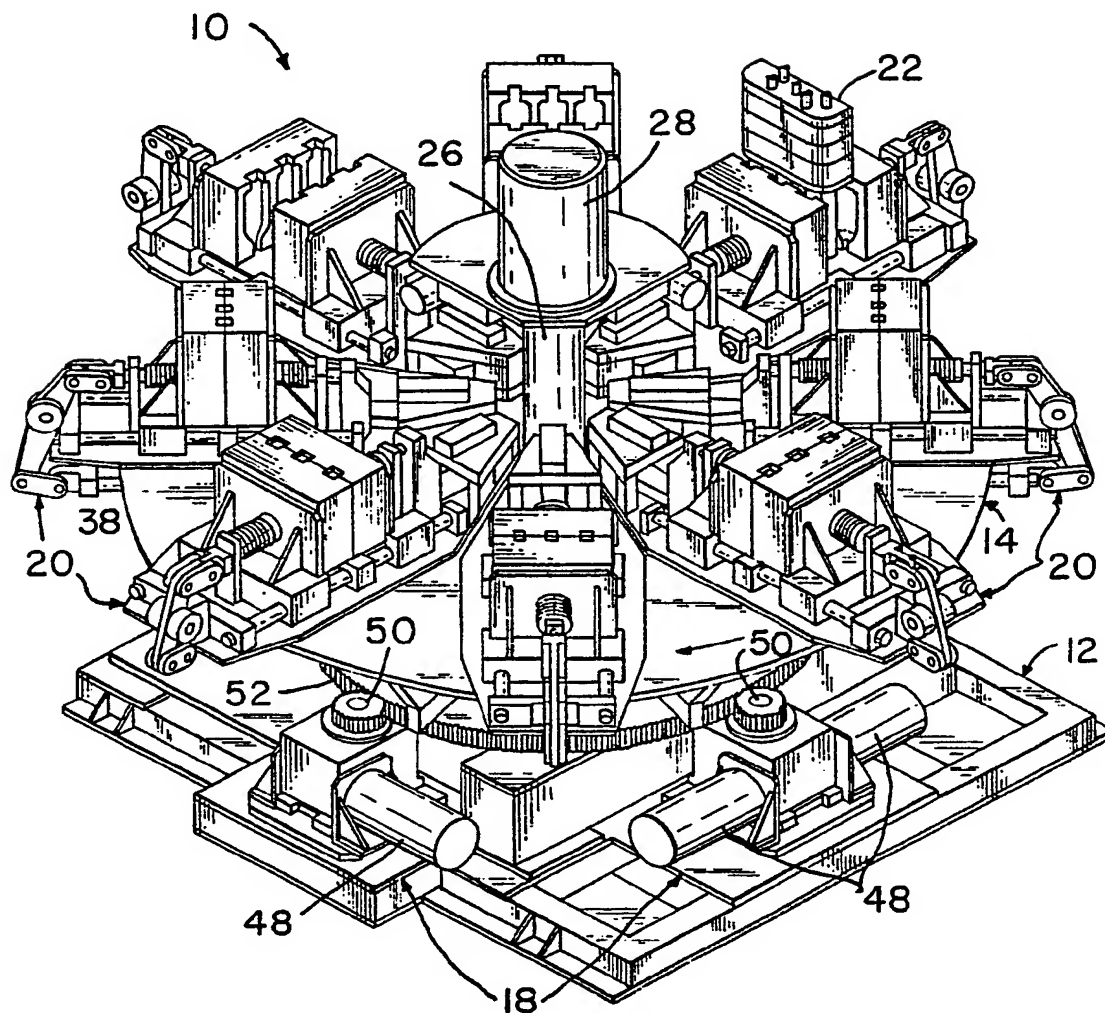


Fig. 1

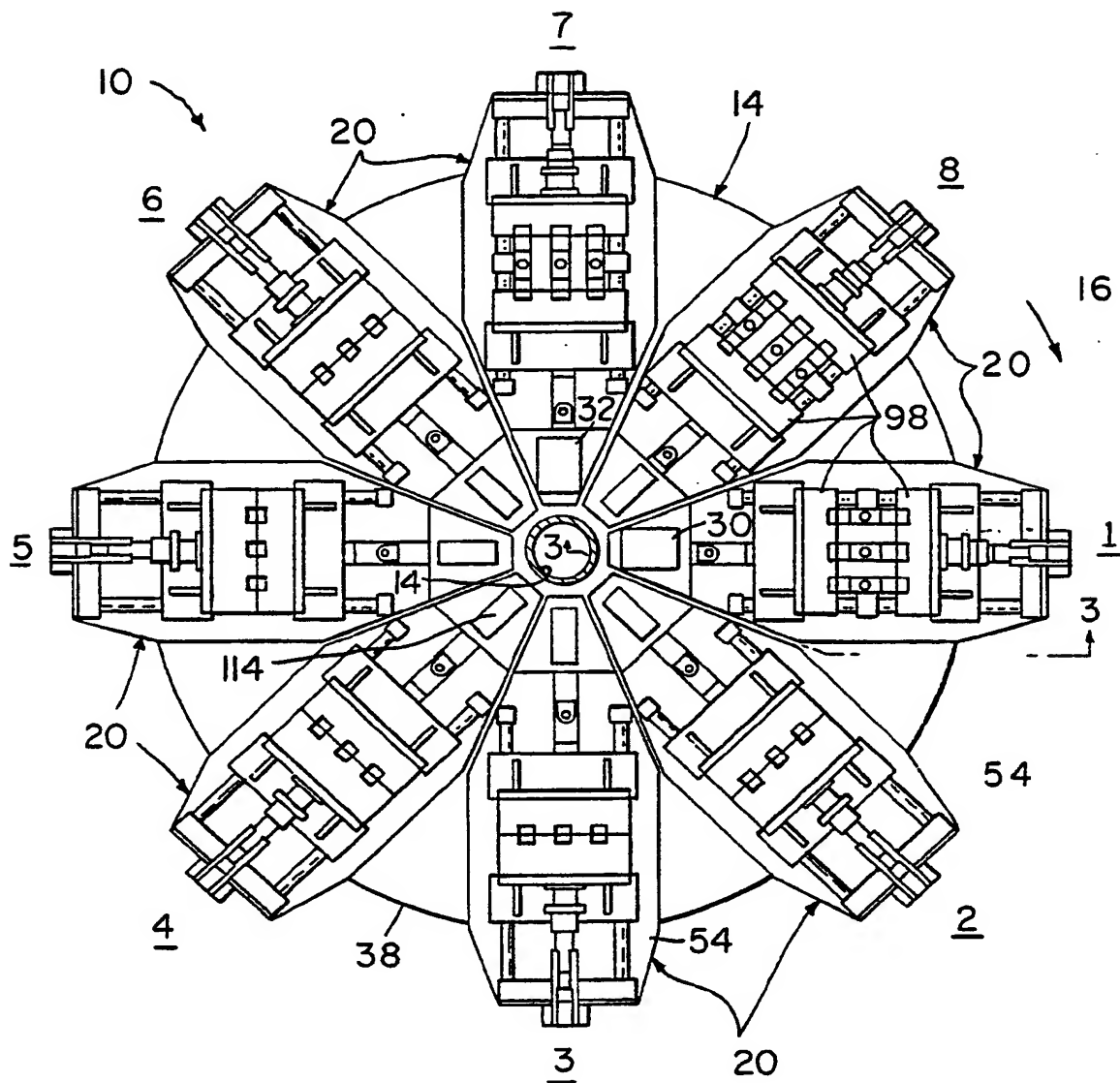


Fig. 2

Neu eingereicht / Newly filed  
Nouvellement déposé

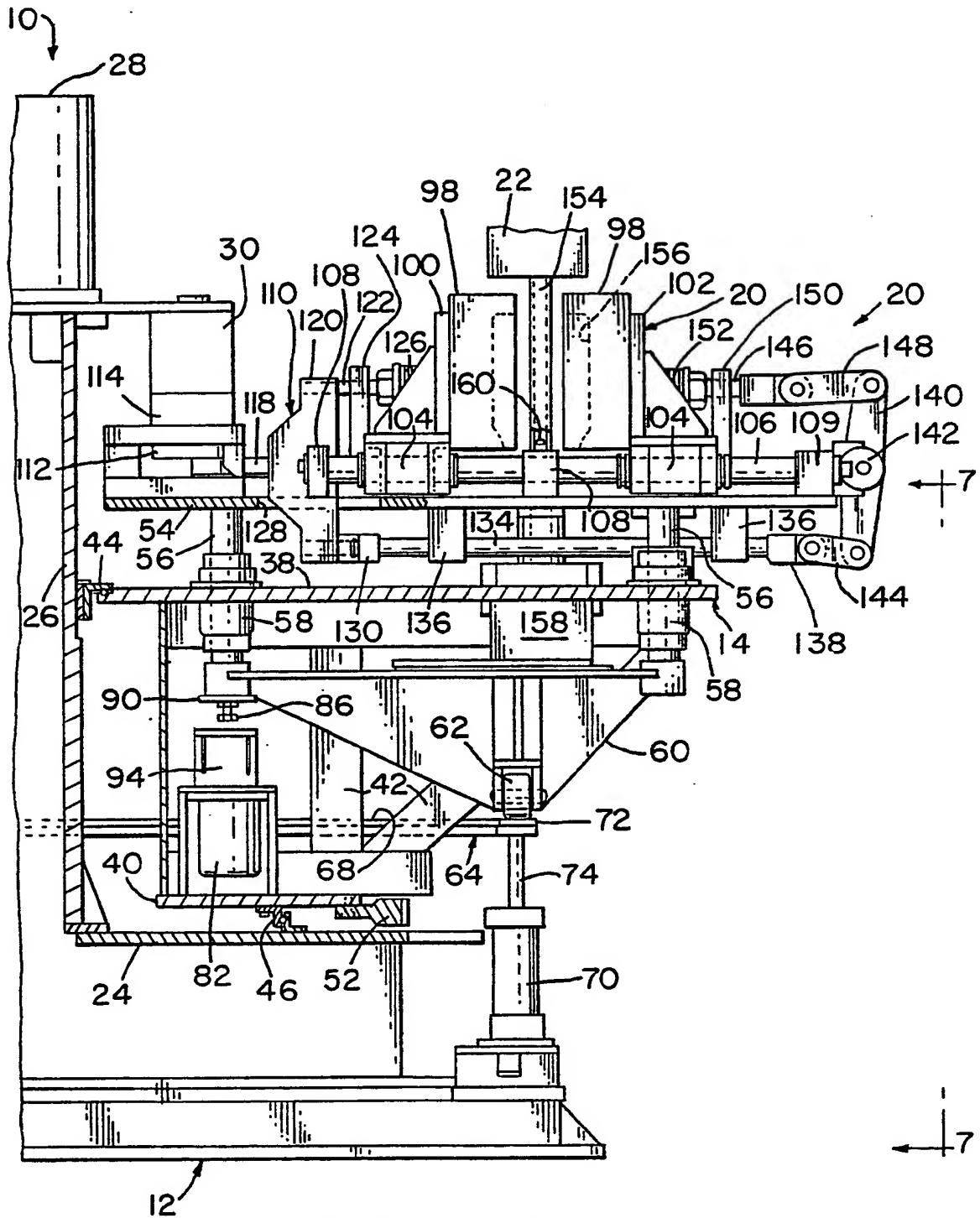


Fig. 3

Not known to be filed  
Nouvellement déposé

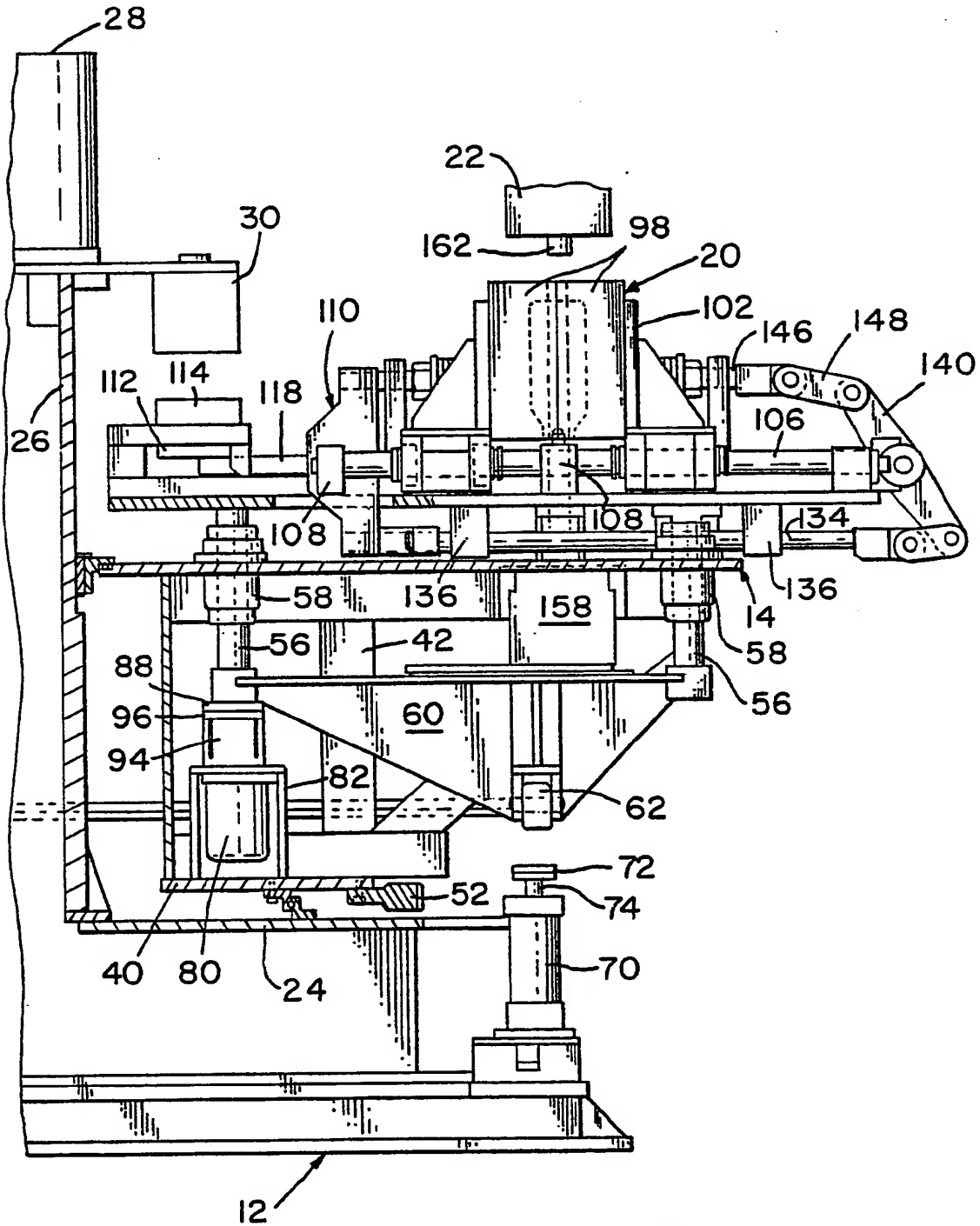
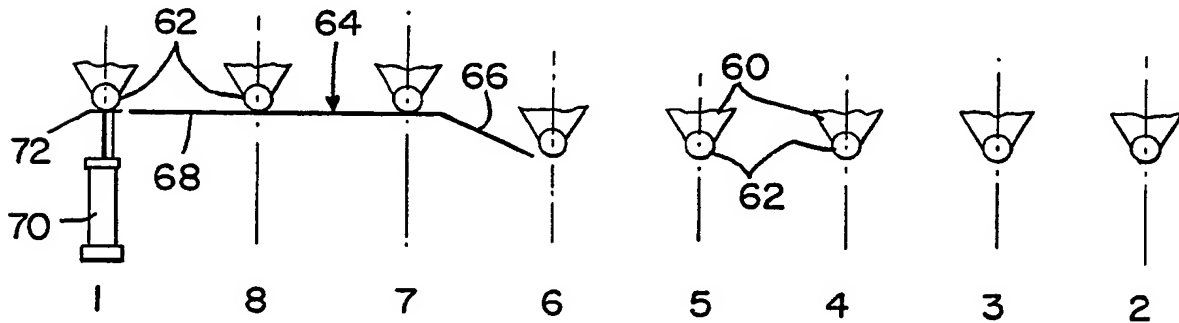
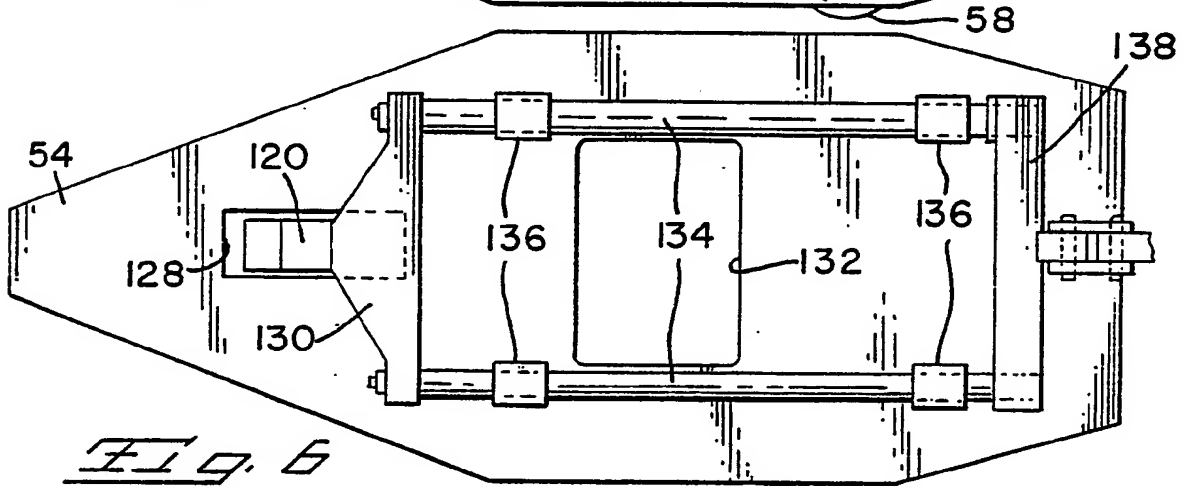
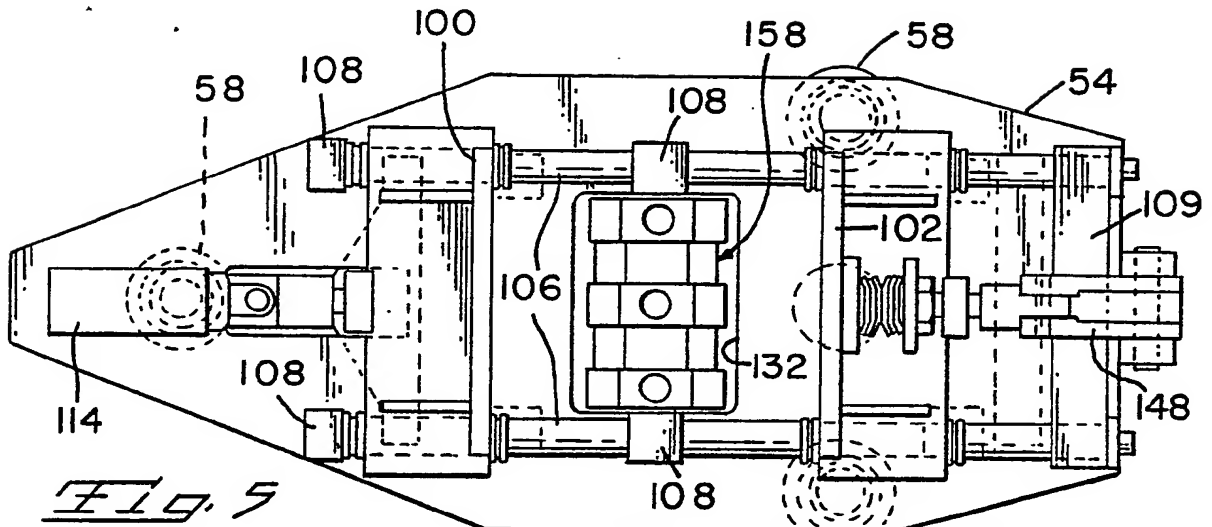


FIG. 4



Neu eingereicht / Newly filed  
Nouvellement déposé

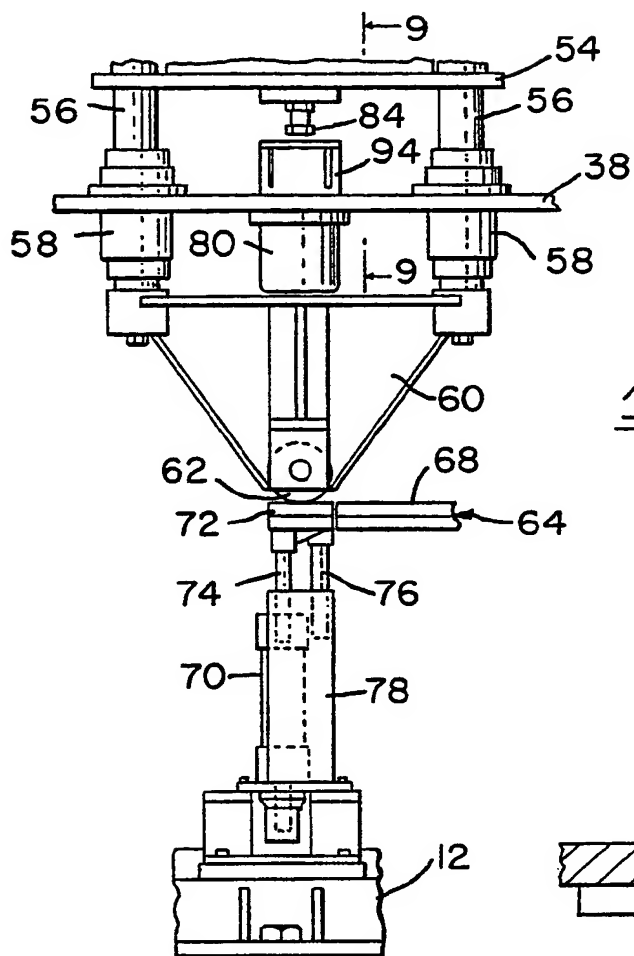
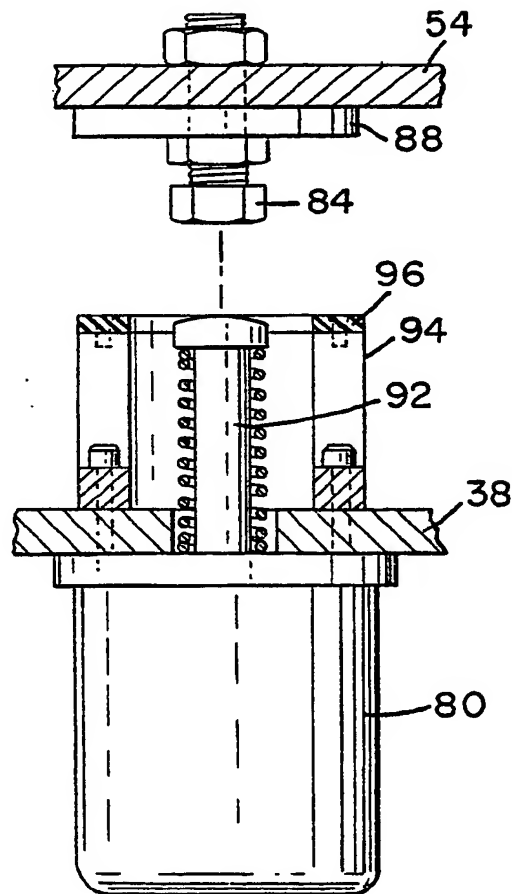


Fig. 7

Fig. 9



(19)



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# EUROPEAN PATENT APPLICATION

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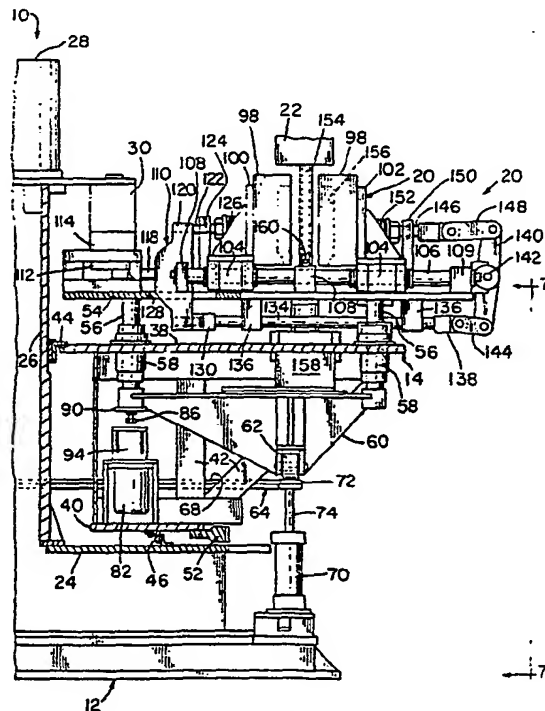
(71) Applicant: **Graham Engineering Corporation**  
1420 Sixth Avenue P.O. Box 1104  
York Pennsylvania 17405(US)

(72) Inventor: **Oles, Paul M.**  
4020 Wilshire Drive  
York Pennsylvania 17405(US)  
Inventor: **Shepps, Frederick J.**  
711 West Philadelphia Street  
York Pennsylvania 17404(US)

(74) Representative: **Warren, Keith Stanley et al**  
**BARON & WARREN** 18 South End Kensington  
London W8 5BU(GB)

(54) **Rotary blow molding machine.**

(57) A rotary blow molding machine includes a base (12), a turntable (14) on the base (12) rotatable about a vertical axis and a number of mold units (20) spaced around the turntable (14). Each mold unit (20) includes a pair of mold halves (98) which close on and capture a growing vertical parison (154) at an extrusion station (22) and then fall away from the parison (154) as the parison is severed. The captured parison (154) is blow molded and cooled as the blow unit (158) is rotated around the turntable (14). The finished article, commonly a bottle, is ejected from between the mold halves (98) before the mold halves (98) return to the extrusion station (22).



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## Application number

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## CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid.  
namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

## X LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions,  
namely:

1. Claims 1-10:  
Blow moulding machine with vertical positioning means for the moulds
2. Claims 11-13:  
Mould-clamp means for a blow-moulding machine

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid.  
namely claims:
- ☒ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims.  
namely claims: 1-10

